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### No. XXX.

*Description of the river Mississippi and its Delta, with that of the adjacent parts of Louisiana. By William Dunbar, of the Natchez, communicated by the Author, a Member of the Society; through the President.*

Read April 6th, 1804.

THE multiplicity of the rivers which are tributary to the Mississippi, extending themselves over an immense tract which comprehends nearly 20°. in lat. and 30°. in long. must render this river, at all seasons, one of the most considerable on the globe. The annual inundation, being supplied from so great a variety of climates, must naturally be expected to be of long duration; and may generally be estimated at nearly half the year; beginning (com. annis) to rise in January, and fall in June; the two extremes being frequently extended by the early autumnal and winter rains in the southern latitudes, and by the protraction of the northern winters, which retards the dissolution of the immense accumulations of snow in those cold regions. At the landing of the Natchez (380 miles from the mouth of the river) the perpendicular ascent of the waters of the Mississippi, from the lowest ebb to the highest inundation, may be estimated at 50 feet. At Baton Rouge (200 miles distant) it was found to be 30 feet; at New-Orleans (80 miles above the mouth) it is about 12 feet; and at the mouth of the river, scarcely any perceptible change is observed, excepting by a stronger current charged with earthy matter rolling into the ocean during the season of the inundation; at which time, all the lakes and communications with the sea are replenished with the waters of the inundation, and the ocean itself is often repelled to such a degree, that fresh water has been drawn up, out of sight of land. This great difference in the perpendicular rise of the waters of the inundation is to be accounted for from the prodigious number of natural canals issuing from the Mississippi, and those immense sheets of water,

often unbounded by a single horizon, flowing over the banks never to return, and inundating vast tracts of country which owe their existence to the creative power of this grand river, and which finally discharge themselves into the Mexican Gulph by an infinite number of mouths, many of which are, in apparent magnitude, equal to the Mississippi itself; the space embraced by the Delta of this river on the sea coast being, from information, not less than  $3^{\circ}$  of longitude.

*Table of the mean altitude of the waters of the Mississippi at Natchez, from the lowest ebb to the highest elevation.*

	<i>Days.</i>	<i>Alt. feet.</i>		<i>Days.</i>	<i>Alt. feet.</i>
January....	1.....	25		July.....	1.....45
	15.....	30		15.....	40
February...	1.....	35		August.....	1.....20
	15.....	40		15.....	10
March.....	1.....	45		September..	1.....7
	15.....	47		15.....	5
April.....	1.....	48		October.....	1.....0
	15.....	48 $\frac{1}{2}$		15.....	0
May.....	1.....	49		November...	1.....5
	15.....	50		15.....	10
June.....	1.....	50		December...	1.....15
	15.....	48		15.....	20

It is not to be understood that the rise and fall of the Mississippi, in any one year, ever arrives to the extent of the above table; it is found that years of least elevations will generally be those of greatest depressions. The table is calculated only to convey some idea of the extremes which have been noted in a series of years, and of the general progress of the inundation both in its advancement and retreat.

By information from the inhabitants of the island of New-Orleans, about 25 leagues above the capital, in the year 1774, it appears that the Mississippi had overflowed its banks yearly for three years preceding, by which they had lost their crops, and

which caused great astonishment, because from the commencement of their settlements, which exceeded 20 years, they had rarely ever seen the Mississippi surmount the level of its banks, and that an embankment, called by the french name of levée, was required only in very few places. Since that period, from year to year, the river has continued to rise higher and higher, which has obliged the inhabitants of Lower Louisiana to prolong and reinforce their levées; in so much that embankments of 5 or 6 feet perpendicular are now required, where as many inches were formerly sufficient. This increasing ascent of the inundation may be naturally accounted for by the gradual extension of the levées on both sides of the river, which became each succeeding year more necessary for the defence of the new settlements against the encroachments of this great river. Those establishments are now extended on either bank to the distance of 60 leagues above the capital; it is not therefore wonderful that high banks in the lower parts of Louisiana should be required to receive and confine a body of water which formerly escaped over a great extent, now occupied by the embankments. In spite of this mode of reasoning, which appears to be sufficiently satisfactory, the Mississippi has ceased to rise to its usual height for these\* three years past; the defect at Natchez has not been less than from 8 to 12 feet, and proportionably in the lower country. Many are the conjectures which have been formed to account for this unexpected great change. Some of the old inhabitants say that the Mississippi has returned to its ancient level, while others pretend (ludicrously enough) that the Missouri has found a new passage into the western Pacific Ocean. It does not appear, that we can assign any physical cause why the Mississippi should have certain periods of years in respect to its inundations; nor have observations been made for a sufficient length of time to establish the fact. The late period of great inundations, which have fallen chiefly under my observations, has been about 27 years, not much short of a cycle of the sun; but whether the inundations of this great river are subject to the influence of any regular cause, must be left to the investigation of future philosophers, profoundly skilled in the laws of meteorology.

\* This account was commenced in 1800.

The waters of the Mississippi are not, at any time, perfectly transparent: during the absence of the inundation, they are not much troubled, presenting a slight milky appearance, which is attributed to the Missouri; but during the time of the inundation, all the rivers which discharge their superabundant waters into the Mississippi are more or less charged with terrene matter, and during the decline of the inundation, the turbidness is sometimes so great that a glass filled with its water appears to deposit, in a few minutes, a sediment equal to one eighth of its bulk; this extreme impurity is not to be attributed entirely to the immediate effect of the Missouri, but principally to the falling in of the mud banks, either newly formed beneath the influence of the current of the river; or undermined by its rapidity, perpetually changing its bed, by enlarging the concavity of its bends, and projecting its points or head lands: this operation has a natural tendency to lengthen the circuitous course of the river; but the effect is amply compensated by its own progress; for the enlargement of the bends frequently brings them so near each other, that the weight of the waters bursts at once through the solid soil, forming in a few days a new bed capable of conveying the whole waters of this mighty river, and shortening thereby its course many leagues. The disruption which took place at Point Coupée, cut off ten leagues, and within this territory the cut-off at the Homochito has thrown to the east of the Mississippi an island of seven leagues in circuit, and at the Yazooz a similar effect has been produced on the west side by the formation of an island of five leagues in circumference. Those islands are now both converted into peninsulas, by the formation of new land across one of the mouths of the old channel, while the other is partially kept open by the discharge of the (comparatively) small rivers of the Yazooz and Homochito; the former of those, nevertheless, is not inferior in magnitude to that great commercial river the Thames. The consequence of those disruptions, is the formation of lakes, which, in process of time, may be far removed from the actual channel of the river, and in effect are now found to be scattered in all situations over the immense valley of the Mississippi.

When those lakes are first approached, they present so perfect a resemblance of the Mississippi, with regard to breadth,

the appearance of the banks, and the natural serpentine form of its course, that many persons have been deceived thereby, and recognized their error only by the discovery of the stagnant state of the water, the appearance on its borders of the *Nymphaea Nelumbo*, and other aquatic plants; no person therefore doubts that those lakes have all, in their turn, served to convey the waters of this father of rivers, and now during the season of the inundation still flow with a full current, contributing their aid to the evacuation of the waters of a thousand rivers which precipitate themselves into the valley of the Mississippi. When we take a survey of this valley, upwards of 30 miles wide opposite to the Natchez, diverging very obtusely as we approach the sea-coast, where it is perhaps not less than  $3^{\circ}$  in long. and that in no part of it do we discover any other soil than such as is now daily deposited by the waters of the Mississippi, it is impossible not to believe that this valley has, in the beginning, been a branch or inlet of the ocean, which received into its bosom this great river, similar to the River de-la-Plata, the Gulph of St. Laurence, Delaware bay, and many others not remarkable for the alluvial properties of their rivers. When, on the other hand, we contemplate the effects of the creative power of the Mississippi, which has filled up this prodigious space with soil, more or less solid, and which must at Natchez exceed 100 feet perpendicular above the level of the sea, sloping gradually like an immense glacis to the coast of the bay of Mexico, where nevertheless it does not terminate, but shelving off by continual accumulation frequently embarrasses vessels out of sight of land, along the coast, to the west of the Mississippi; I say when we survey this immense work performed by the hand of nature, we cannot accord with the opinions of certain visionary philosophers, who have been pleased to amuse themselves with the pretended infantile state of our continent, compared to their trans-atlantic world; but, on the contrary, we must grant to it an incalculable antiquity. When the inundation is at its height, the whole valley is replenished with water every where in motion, making its progress towards the ocean; so that at that season the river may be said to be 30 miles or more in breadth at Natchez; the waters which pass over the

west bank of the main channel never return; on the east, a chain of high land, which at many points is washed by the river, meandering along its valley, compels its waters to rejoin the primitive stream; but from Baton Rouge, the high land which has hitherto held a southerly course, diverges suddenly to south east, and is no more visited by the grand channel of the Mississippi; all the waters which escape to the eastward between Baton Rouge and Mansiac (15 miles) are collected by the Iberville, which, passing through a breach in the high land of about 60 yards wide, delivers its contents to the river Amit, which empties itself into lake Maurepas, communicating with the ocean by the intervention of the more considerable lake Pontchartrain: the high land is continued in a very narrow tongue or promontory, in a south easterly direction, along the island of New-Orleans, which is disrupted in many places, thereby venting the waters of the inundation into the lakes, which otherwise would be collected into an oblong basin, formed by the high land on the one hand, and the bank of the river on the other—one half of the island of New-Orleans would have thereby become so completely inundated as to be uninhabitable.

The perpendicular height of the high lands above the level of the inundation is from 200 to 300 feet at Natchez; at Baton Rouge it does not exceed 25, and on the island of New-Orleans it declines so rapidly as frequently to be lost under the accumulations of soil deposited by the waters of the inundation. In the sides of a canal from New-Orleans to the river St. John's, communicating with lake Pontchartrain, I discovered the continuation of the high land cut through to the breadth of little more than 20 feet.

To a stranger, the first view of the Mississippi conveys not that idea of grandeur, which he may have pictured to himself: his first judgment will rest upon the appearance of its breadth, in which respect it is inferior to many rivers of much less note. Its principal channel is rarely a mile in width anywhere below the Ohio, unless where its stream is divided by islands or shallows; it is not unfrequently less than half a mile. The magnitude of this river is not to be computed by its width,

but by its depth; in which it is perhaps equal to any on the globe; but is so contracted at the place of its entrance into the ocean, as to be there less in width than it is found to be at a thousand miles from its mouth; the cause of this peculiarity is, perhaps, not difficult to develope. The natural effect of rivers is to encrease continually the depth and breadth of their beds, by the perpetual abrasion of their waters; such must be the consequence with regard to all rivers which do not supply by alluvion a sufficient quantity of matter to counteract this effect. Certain rivers, which in the upper part of their course pass through fertile regions, whose rich and tender soil is easily broken down and carried away by the impetuosity of the current, not only supply this deficiency, but discharge such inconceivable quantities of earthy matter, as to fill up, in a great measure, those spacious bays and channels, scooped out by the hand of nature, in order to facilitate the mingling of their waters with those of the ocean; in such circumstances the breadth of the river will always be in proportion to the mean quantity of water discharged during the time it flows within its banks; for it is to be remarked, that during the time of the inundation the common channel of the river is in some measure lost in the immensity of waters, which flow over its banks in all directions; the bottom and sides of the channel, during this time, suffer no abrasion, but, on the contrary, from the diminution of the velocity of the inferior currents, gain rapidly upon the breadth of the river: the moment the current of the river is confined within its proper banks, it begins to exert its dominion over its own channel, and fashions its bed by the momentum of its waters, attacking sometimes one side, sometimes the other, according as the main filament of the stream is deflected from shore to shore; by which means large portions of the newly-created soil are preserved, while in other situations the more compact earth is undermined and borne into the ocean, and thus an equilibrium is restored between the channel and its included waters; hence it comes to pass that rivers which run through alluvial countries are much narrower in proportion to the quantity of their waters, than those whose courses are over rocks, gravel or sand; but on the other hand their depths

are great, and they are consequently better fitted for the purposes of navigation. The Mississippi is supposed to be navigable (pursuing the western branch or Missouri) 3000 miles at least from the ocean. Those who have studied the theory of rivers inform us, that the stability of the bed of a river depends upon a due equilibrium between the velocity of the current and the tenacity of those matters which compose its bottom and sides: the velocity of rivers is greatest at the surface, gradually diminishing downwards; hence when the bottom is composed of matter of the most yielding nature, the channel will continue to deepen until the velocity at bottom is almost nothing, and the depth of the water will be regulated by those circumstances: the bottom of the bed of the Mississippi, within the alluvial country, being composed of the finest sand and lightest earth extremely comminuted, it is not surprising that its depth should be comparatively great; its soundings have (it is believed) never been taken with minute attention, but from New-Orleans to the mouth of the river, its depth is said to be from 50 to 70 fathoms, under the thread of the current, which follows the concave shore; diminishing gradually towards the elbows, where there are frequently considerable shallows. The sudden effect of the diminution of the velocity of water is no where more remarkable than at the mouth of this river, for the rolling torrent no sooner arrives at the ocean, than, finding its bed indefinitely enlarged, it spreads on all hands; the thread of the current diverges, into an infinite number of filaments like radii from a center; the velocity of the mass of water rapidly diminishes until, no longer able to propel the matter hitherto suspended and swept along by the swiftness of the stream, it is deposited in form of a crescent, opposing to the mouth of the river, a bar with from 12 to 20 feet water. The current being less, immediately to the right and left, than in front, of the mouth of the river, the deposition and accumulation of matter will consequently proceed more rapidly on either side, and the velocity of the current being increased by the contraction of the channel, the bar will be protruded further into the ocean; hence it appears why the mouths of all alluvial rivers terminate in a promontory pro-

jecting more or less into the ocean; this last mentioned operation of nature points out the method of improving the navigation of the entrance of the Mississippi, which may be effected at no very considerable expense by carrying out a pier on each side of the principal branch, composed of piles, so far as may be found sufficient to procure the desired depth; the bar will thereby be thrown into deeper water, and in process of time will accumulate and ascend to its former height, which will demand a new prolongation of the piers. Every small rivulet passing through lower Louisiana is a miniature of the Mississippi; what may be performed upon a small scale in respect to the latter, will certainly succeed (by well directed efforts) on the former.—The river St. John's, 60 to 80 feet wide, entering lake Pontchartrain to the north of New-Orleans, was found frequently so choaked up and impeded by a bar across its mouth, that canoes could sometimes with difficulty enter; sloops and batteaux being obliged at such times to remain in the lake exposed to danger; the government directed two very simple piers, each composed of a double row of round rough piles, to be carried from the shore across the bar, and although the piers were pervious to the water, yet so much velocity was acquired, that the bar was very speedily swept off, and the river has always since remained navigable for small sloops and schooners, which proceed up to the city by the river and canal of Carondelet.

The depth of the river diminishes considerably as we advance upwards; probably owing to the increased tenacity of the matter forming its bed; at Natchez, when the waters are low, it is about 12 fathoms, and there are situations below the Ohio, where the ordinary boats have been embarrassed to find a passage both upwards and downwards; a moderate fresh nevertheless renders the Mississippi navigable up to the falls of St. Anthony, about 2000 miles from its mouth: The breadth of the river appears to be upon the increase upwards, in proportion as we get above the alluvial country, as high as the Missouri, notwithstanding the loss of a number of principal rivers which flow in below; in latitude  $42^{\circ}$ . it is said to be half a

mile in breadth, which probably equals its mean breadth from Yazooz to its mouth.

The margin of the river is the highest land to be found in the valley of the Mississippi.—As the river overflows its banks, the waters immediately begin to deposit their grossest particles, which are chiefly sand and black marl, and in their progress backwards this deposition is continued until at length, a matter is deposited so highly levigated that, upon the retiring of the waters, it assumes a compactness and solidity resembling pitch: when the river by disruption alters its course, and new accumulations of slime sand and marl are laid upon this very compact earth, a false belief might be induced that this solid soil is not the offspring of the river, but the original parent earth coeval with the Mississippi itself, upon which this great river had afterwards deposited the rich spoils of the northern regions, borne down by its mighty tide; this compact soil I have found at the depth of from 10 to 30 feet; and in other situations no appearance is to be seen of any other than the common soil formed of the mud of the river. The soil near the river is sandy, particularly that which has been lately formed; from a quarter to half a mile from the margin of the river the sand is less apparent, and it loses its name of ‘terre sablonneuse,’ acquiring that of ‘terre grasse,’ being the richest black marl, with a moderate admixture of sand; at greater distances, and frequently at some depth under the last mentioned soils, is found the above mentioned compact earth, called glaise (potters earth); it is no doubt eminently adapted to the use of the potter, though hitherto not much applied to the manufacture of earthen ware. Upon all lands long subject to culture and defended from the inundation, although near to the margin, the appearance of sand is almost lost, but it is evident from the friability of the soil, and the facility with which it is cultivated, that a large portion still remains intimately mixed with it, whereas the terre grasse (unmixed or pure marl) yields with difficulty to the plow; it exhibits proofs of the richest marl, a slight shower causing it to crumble into powder after being turned up; yet as our climate is exposed to sudden and violent falls of rain with

subsequent hot sun-shine, it frequently becomes so firm and unyielding, after the crop has been planted, that no mode of cultivation can be conveniently applied, but barely scratching the surface with the hoe; yet this became with the French indigo planters a favourite soil; although less productive, it is more easily kept clear of weeds, the compacted soil refusing a passage to their tender fibrous roots, while the vigorous tap-root of the indigo plant conquers the obstinacy of the subjacent stratum. From the river bank a natural glacis is formed, whose declivity at New-Orleans may be at the rate of 6 or 8 inches in 100 feet, to the distance of 6 or 700 toises, diminishing, after which the descent becomes almost imperceptible, and is gradually lost in swamps, marshes and lakes, which finally communicate with the sea.

This peculiar structure of the lands formed by the operation of the great river itself, has pointed out to the ingenuity of man, a simple and natural mode of defending his plantation against the encroachments of the inundation: he commences by forming an embankment near the margin of the river, elevated above the highest waters and of sufficient strength to resist their pressure; he is now protected from the direct influx of the Mississippi, but the transudation from the river is so considerable, that his plantation would be no better than a quag-mire; he is therefore under the necessity of establishing a regular system of ditches crossing each other at right angles, by which the soil is completely drained and placed in the most favorable situation to display the wonders of its inexhaustible fertility.—Within the Mississippi territory a vast body of alluvial land exists, but the scheme of draining by cross ditches would produce here no beneficial effect, because the waters find no means of escaping in the rear, but being hemmed in by the high land, would at length accumulate so as to produce an immense basin, bordered by the embankment on one hand, and by the high land on the other: although no successful attempt is likely to be made in our day, yet posterity will reclaim those lands: when the industry of a full population, shall have stamped an intrinsic value upon the soil of our country, the ingenuity of man will discover a remedy; probably the steam engine so highly improved of late years.

will be called in to accomplish this object. Its application in Holland to the draining of the Haerlem meer, and even for the reduction of the Zuyder-Zee, which the late war, it appears, has indeed suspended, leaves but little doubt of its full efficacy for a purpose of inferior magnitude. Lands susceptible of cultivation do not upon an average extend to three quarters of a mile from the river, although in some places they may reach to two miles, but in other situations do not exceed one quarter of a mile: there is no doubt that a scrupulous attention to the perfection of the embankments will every where augment the quantity of cultivable land; and we hazard nothing in predicting that at some future day, the productive surface of lower Louisiana will be multiplied ten fold: a rich and enterprising population, conducted by a wise and patriotic government, will pierce, with navigable canals, this alluvial country in all directions: grand issues will be provided to conduct to the ocean the superfluous waters which now drown, for three months of the year, nine tenths of the country; the whole surface of the land will then be reclaimed and become fit for the habitation of man; the richest harvests will be collected from a soil of the most exuberant fertility, which perhaps no time can exhaust: should however vegetation at length seem to advance with a sluggish pace, the planter has his remedy at hand, he may call in the aid of the elements; let the waters of a single inundation flow over his field, and it will receive a manure which 20 years cultivation cannot absorb. Reservoirs might be formed, as in ancient Egypt, to retain a portion of the waters of the inundation, but this happy climate does not require such precaution; the season of the inundation furnishes less rain than at other times, but it is so ordered by the course of nature, that about the time the waters retire, refreshing showers fall almost daily throughout lower Louisiana, which continue to invigorate the crops until the approach to the harvest season.

The inundation takes place during the season that the crops are under cultivation, and in the precise time when required for perfecting the culture of rice, which is therefore most conveniently placed in the rear of the plantation; nor is the inundation necessary for any other species of crops, but on the

contrary is often extremely injurious by its excess; the embankments are frequently ruptured, and the crops of many plantations are totally lost; the lives of the inhabitants are sometimes in danger from the disruption of their levées in the night-time; this however is but a rare case. The planters possess great experimental knowledge in the art of arresting the progress of this devastation, and even entirely shutting up the breach which has been made by the torrent of the Mississippi. They begin their operations at some distance from the extremities of the breach at sound parts of the embankment, and, advancing in form of a crescent towards the margin of the river, where they know the land to be most elevated, they are often enabled to shut out the river by this process, the greater part of the work being thus carried on in water comparatively still; whereas every inch of the breach is acted upon by a furious torrent, becoming every instant deeper and wider. A very great breach happened during Governor Miro's administration about three leagues above New-Orleans; an immense body of water advanced on its rear and threatened to drown the city; the people were discouraged.—The Governor called out all the assistance which could be spared from town and country and placed himself in the row of common labourers, transferring his sod from hand to hand, to those who, from their superior knowledge in this species of hydraulic architecture, were employed in constructing the provisional embankment: they did not succeed in completely shutting up the breach, but the quantity of overflowing water was reduced to one quarter, and the extremities of the new levée were fortified until the retiring of the waters; vast quantities of fish were precipitated upon the land, which corrupted and filled the air with a pestilential stench. The town was unusually sickly that season.

The Mississippi is already celebrated on account of the salubrity of its waters; in which respect, no doubt, it rivals the Nile. It seems to be admitted (perhaps without due investigation) that it possesses properties favorable to the multiplication of the human species, by promoting fecundity; it is probably more certain that the use of its waters contributes to banish several disorders common in other countries: the gout would be unknown were

it not introduced by strangers; and instances of the stone and gravel are extremely rare. The Creoles who drink this water are a comely race, both male and female, of middle stature, and handsome persons; the males are ingenious, active, bold and enterprising; fond of hunting and other laborious amusements, and capable of enduring great fatigue: the gracefulness and beauty of the ladies are universally acknowledged.

The water of the Mississippi is drunk in great purity by the first class of French planters, and inhabitants of New-Orleans; it is suffered to deposit by repose (in large earthen jars containing a hundred or more gallons) its sediment and feculencies; the precipitation is some times accelerated by bruised peach stones and kernels. Volney says that in Egypt bruised bitter almonds are applied to the same purpose; certainly the process of the Chinese is much neater by means of alum. The inhabitants generally employ two jars, in order that one may be filled while the other is in use, by which means they always drink the purest water: those who are long in the habit of drinking the Mississippi water, cannot immediately reconcile themselves to the taste of any other.

When the river is low and the current extremely gentle, the water possesses but a very slight degree of turbidness; the current is however at all times sufficiently strong to roll an immense body of water into the ocean, in which respect the diminutive Nile cannot bear a comparison; the waters of the latter being frequently in a state of \*corruption immediately before the commencement of the inundation; the Nile becomes also shallow in many places, whereas a ship of the line might find, at all times, sufficient water 6 or 700 miles up the Mississippi, were the impediment on the bar removed.

There is a very striking difference in the momentum of the waters of the two rivers at their entrance into the sea; that of the Mississippi is at all times sufficient to preserve 17 feet of water upon the bar of the principal branch, whereas the mouths of the great branches of the Nile are so choaked up with mud and sand, that small coasting vessels can scarcely enter, and this is practicable only through a very narrow winding channel,

\* Volney.

which resembles very much the entrance into many of the creeks, which to the westward of the Mississippi serve to dis-embogue the waters of the inundation.

The Mississippi has its Delta as well as the Nile, but that of the former is much more extensive than that of the latter; if we suppose the apex of the Delta of Egypt to be at Grand Cairo, near which the high land diverges considerably to the east, its latitude from south to north will be nearly a degree and a half; and its base, along the sea coast, about two degrees: if we admit the Delta of the Mississippi to commence only at Natchez (although there is an immense body of alluvial land above) opposite to which the high lands on the west of the valley open to the right with a rapid divergence, its latitude will be not less than two degrees and a half, and its longitude, on the coast, about three degrees; hence it results that the superficial content of the Mississippi Delta is to that of the Nile as 5 to 2, which may be adopted as the proportional magnitude of the two rivers, though there is reason to believe that our Nile pours into the ocean a much greater proportion of water than what we have stated, and that the Delta of the Mississippi would have been much more extensive, were it not placed in the tract of a perpetual vortex formed by an immense current in the sea, occasioned by the tropical east winds forcing the ocean against the oblique coast of America, which produces a continual flux between the main land and island of Cuba, giving birth to the well known gulph stream; but a great body of this current, rushing on with impetuosity in a direct line northerly, impinges against the west coast of East Florida, and is there deflected and dashed along the coasts of East and West Florida, Louisiana and Mexico; and by the promontory of Yucatan is thrown again into the main current, thus constituting a permanent vortex, which sweeps along a great proportion of the spoils of the Mississippi, as fast as they are projected into the ocean: in confirmation of this position it may be remarked that the bay of Campochy, so favourably situated for the reception and retention of alluvial matters, is exceedingly embarrassed with shoals of sand and mud; so that vessels of moderate burthen can scarcely get within 2 miles of any part of the coast; this evil is upon

the encrease, and can only be attributed to the operation of the current, taking up every moveable matter along our coast, and depositing it in every bay or creek in contact with the circumference of the vortex: there are no alluvial rivers flowing into the bay of Campechy; but the Rio del Norte, and one or two others of less note, contribute no doubt to the production of this effect, by throwing their mite into the ocean.

Pursuing our parallel of the two rivers, we shall find that the Mississippi as well as the Nile, proceeds to the ocean by two permanent branches, that to the west breaks off, about two or three miles below the Red River, and bears the Indian name of Chafalaya, or river of the Apelousas: there is every appearance that this branch may have anciently been a continuation of the great Red river; the quantity of water delivered by the one and received by the other being nearly equal, and the general appearance of the banks and common breadth of the channels being very similar. The Chafalaya is dangerous for boats under the conduct of unskilful pilots descending the Mississippi; the velocity of the stream passing laterally out of the Mississippi, occasions an attraction (if the term may be admissible) of all floating bodies at a considerable distance from the shore; if the unwary or ignorant voyager falls within the sphere of this attraction, and his boat be not sufficiently manned to enable him to escape, by taking an oblique course out of this unexpected suction, he is precipitated into the western branch; heavy boats connot regain the Mississippi; the lightest must be well manned to stem the extreme rapidity of the current; the perpetual rising of the bank and bed of the great river from the influence of the inundation, is probably the cause of so precipitate a descent into the smaller river. The Chafalaya was formerly, but is not now navigable into the country of the Apelousas and Alacapas; the inconceivable quantity of drift timber which went down, had formed many islands, which so contracted the different channels, that at length they have been entirely shut up, (not to the passage of water, but) to the passage of every kind of craft; there is said to be at this time a floating bridge upon the Chafalaya, ten leagues along the course of the river, and continually accumulating by the cause which produced it: some parts of it

are so compact as to have an appearance of solidity; and vegetation has made considerable progress thereon.\* The Chafalaya in its progress through the Delta collects many other inferior streams, and before its junction with the ocean becomes, in certain situations, a mile in width; it is said to have nine or ten feet water on its bar; it is probably superior to the Phatmetic branch of the Nile, but is not equal to one tenth part of the Mississippi. The mouth of the Chafalaya is probably distant from the principal mouth of the Mississippi nearly 150 miles, and is now unnoticed; at some future period its river will be crowded with vessels and boats transporting the rich harvests of its ever-productive soil. There are many other inlets along the coast of the Delta which flow with fresh water during the inundation, and admit the waters of the ocean at other seasons: those have all got their bars, and are, as before observed, miniatures of the Mississippi; a small tide of about three feet perpendicular facilitates the passage of those bars for small craft, some of them are seen above water while the tide is out; the remedy for the removal of those bars has already been noticed: our posterity will see those inlets or *bayous* converted by the hand of industry into extensive navigable canals, penetrating in all directions this tract of inexhaustible fertility, which will become the garden of the United States.

Sugar having become of late a staple commodity of the lower country, it cannot be uninteresting to enquire how far, in its present state, it is susceptible of that culture. The following short statement is derived from the practical experience of the planters. It is now admitted that the sugar cane does not arrive (regularly) to full maturity beyond 75 miles above New-Orleans, following the sinuosities of the river; and this corresponds with a line drawn westerly along the sea coast of Pensacola and Mobile, crossing the island of New-Orleans: below the city the lands decline so rapidly that, beyond 15 miles, the soil is so much imbrued in the waters of the Mississippi, as to be totally unfit for the culture of the cane; within those limits, the most expe-

\* Note. A certain extent of the Red River is in this situation; the water is heard gurgling under foot, being completely concealed by a stratum of timber upon which there is soil sufficient to support plants, and even trees of moderate size.

rienced planters admit that one quarter of the cultivated lands of any considerable plantation may be planted in cane, one quarter left for pasture, and the remaining half employed for provisions &c. and a reserve for change of crops. One Parisian arpent, of 180 feet square, may be expected to produce, on an average, 1 hhd. (12 cwt.) of sugar, and fifty gallons of rum. From the above data, admitting that both sides of the river are planted for ninety miles in extent, and about three quarters of a mile in depth, it will result that the annual product may amount, in round numbers, to twenty five thousand hhds. of sugar, with twelve thousand puncheons of rum. Enterprising young planters say, that one third, or even one half of the arable land might be planted in cane; it may also be remarked, that a regular supply of provisions from above, at a moderate price, would enable the planter to give his attention to a greater body of land cultivated in cane: several of the departing branches of the Mississippi furnish strips of land along their margins within the sugar latitude; there is also a portion of the Atacapas, parallel to the sea coast, favorable for this culture; every circumstance being therefore taken into view, we may admit that in the existing state of the lower country, double the quantities of sugar and rum above mentioned may be produced, although hitherto the annual product has only been about 5000 hhds. of sugar.

When the immense regions watered by the tributary streams of the Mississippi, particularly those extending to the sources of the Missouri, shall be opened up and cultivated by the persevering labor of man, our winters will be enchain'd in the north, and a milder climate will extend itself over the whole of the Delta; and as it lies under the same parallels of latitude, so will its productions be similar to those of the Delta of Egypt: and if we extend our views to a future period, when the waters of this great river shall be completely under the control of man, by a regular system of canals and embankments, such as probably existed in Egypt during its best days under its ancient kings, some idea may be formed of the inestimable value of a country, which most happily for itself and for the United States, now constitutes a very precious portion of the union.

It has already been said that the tides on the coast rise about three feet perpendicular, but they are not lunar tides; another cause must be sought: the bay of Mexico being a species of Mediterranean sea, surrounded by the continent and a close chain of islands, is not sensibly susceptible of the gravitating power of the sun and moon; the tides take place only once in twenty four hours, and nearly at the same hours in the morning; they depend altogether upon the winds, which, during the regular summer season, blow in upon the land all day; and in the night, it is either calm, or there is a small returning land breeze: the sea breeze commences in the morning about nine or ten o'clock, and ceases in the evening about sun set; the waters having acquired a momentum from the action of the wind continue to rise until about day break, when it is high water; a tide depending upon such a cause must be subject to frequent anomalies: in the winter, as may be expected from this theory, the tides are extremely irregular, being governed by the variable winds of that uncertain season.

This small tide produces an effect upon the Mississippi; I have noted at New-Orleans (during the absence of the inundation) a rise of fourteen inches, about sun rise; and at Man-shac from 6 to 8 inches; this ascent of the waters of the Mississippi is produced merely by a swell or wave; the current at the same time continually issuing from the channel into the ocean; this tide requires a considerable time to make its progress upwards against the current: those who have perused Condamine's account of his voyage down the Maragnon are acquainted with every thing that can be said upon this curious subject. The great Newton has observed, that the tides which take place nearly at the same time at London-bridge, and at the mouth of the Thames, are not the same; but that at the bridge is the same which happened twelve hours before at the Nore.

It is probable that any tide coming up to New-Orleans is the same which arrived three days before at the mouth of the river, consequently the distance from New-Orleans to the mouth of the river is divided by the tides into three parts; (i. e.) one tide at each extremity, and two others making their progress

upwards. This statement is only conjectural, founded upon probable circumstances, having been unable to procure a sufficient number of accurate observations to be made at different points.

When the river is very low, the velocity of the stream is scarcely a mile per hour at Natchez, and much slower at New-Orleans, probably not above half a mile; but during the time of the inundation from 4 to 5 miles.—It is asserted that the current is swifter during the night than the day; this perhaps might be accounted for by saying, that there is generally a breeze by day blowing up the river, which opposes the current and dams up the water to a certain degree; and that the night being generally still, the water descends with accelerated velocity; but another fact is not so easily accounted for, viz. that saw-mills, which are constructed upon canals leading from the Mississippi, perform more work (*cæteris paribus*) in the night than in the day, the number of strokes of the saw being found greater in a given time.—The encrease of the specific gravity of water by the coldness of the night will be of no avail in the solution of this question, because the weight and velocity of water in a lateral canal cannot thereby be increased. We cannot suppose that the evaporation during the day produces a sensible effect in diminishing the quantity of water, because the water thus diminished in the course of the day arrives at the mill during the night. Is it not rather owing to the perfect stillness of the night, that the machine performs its office without any unnecessary agitation or friction, which in the day is greatly promoted by the vivifying influence of the sun, causing a more rapid circulation of the atmosphere, and exciting to motion every body on the surface of the earth, whether animate or inanimate? It is known to mariners that the relative cessation of motion on board a vessel under sail, contributes greatly to the rapidity of her movement. This phenomenon merits a more perfect solution.

Although the velocity of the water has been said to be from one to five miles per hour, yet this is to be understood of what may be called the thread of the current, it being considerably less along the shores, and very frequent counter-currents or ed-

dies of great extent are found in favorable situations, which greatly facilitate the ascending navigation of the river; but as the current is continually deflected from shore to shore, boats are at many points unable to stem the force of the current, and are under the necessity of crossing frequently to get as far as possible out of the main current.

No abrasion takes place at the bottom of the channel of the Mississippi (in Lower Louisiana), an equilibrium has long since been established; it is believed rather that its bed is on the rise: as the margin of the river rises by the influence of every inundation which passes over it, it is thought that the bottom must rise also; but this effect must depend altogether upon the protrusion of the cradle of the river into the ocean, by which means the extremity of the inclined plane which the river has carved out for the conveyance of its waters, being prolonged horizontally, the waters within the channel must acquire a new elevation, placing themselves parallel to their former position, and the bed of the river will rise proportionably so far only as the alluvial bottom extends; and thus there will be a low but progressive rise of the margin and bed of the river, which is perfectly agreeable to observation.

The formation of land is surprisingly quick in certain situations; the moment the waters lose their great velocity, they begin to deposit their contents; the most favorable position is on either side of the main channel, where the current is nearly but not absolutely destroyed: as for example, when the river suddenly makes a breach or cut-off from bend to bend, leaving a circle of several leagues of the former bed with little or no current, the waters immediately begin to block up the two entrances, leaving the interior in form of a lake: in 5 years the soil will be tolerably firm, nearly of equal height with the adjoining lands, and covered with forests of willow and cotton-wood (probably *populus deltoides*\*) 50 feet high; some parts of the old channels were perhaps not less than a hundred feet deep: this wonderful creative power of the Mississippi may, by the ingenuity of man, be applied to the accomplishment of grand objects: by proper embankments, and a regular supply and discharge of the waters of

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\* Of Bartram.

the Mississippi, the surface of the earth may be raised to a great height, far above the general level of the inundation: travellers inform us that the towns and villages of the Delta of the Nile are built upon elevated situations, which are so many islands during the season of the inundation. How shall we account for the formation of those islands? we have no reason to believe that they pre-existed in the Delta, and they could not be formed by the natural agency of the inundation; the accumulation of earth by mere labor for the formation of so many islands would have been an Herculean task; it is therefore more rational to suppose that the ingenuity of the aborigines of ancient Egypt, directed by the example of nature herself, pursued the more simple and facile mode of elevating the site of their habitations in the manner above described.

We shall conclude the above imperfect sketch by observing, that it is the result of occasional observation for a series of years, and of scattered information collected from various sources, probably often uncertain, from a cause which is unfortunately too general; viz. the extreme inattention of persons, even of some education, to the most curious phenomena passing daily under their review.

Circumstances did not favor the investigation of several points of curious enquiry. It would be desirable to ascertain the obliquity of the inclined plane by which the Mississippi conveys its waters to the ocean, both at the surface and at the bottom of the river, and at various distances from its mouth; as also the respective velocities of the water in those positions, at low and high water. The difference of the velocities of the water at and under the surface, was turned to account by an ingenious master of a vessel, who, finding himself detained in his descent by a calm, dropt his anchor ten or a dozen fathom below the surface, by which his vessel was so much retarded in the stream as to enable him to steer sufficiently to keep clear of the shore. This hint might perhaps be improved to advantage: a much more perfect instrument than an anchor may be invented for the purpose of holding the inferior current, and in situations similar to the Gulf-stream, a vessel may thereby be enabled to escape an enemy.

A Chart of the alluvial country is a desideratum, with which it is to be hoped the curious will in due time be obliged, under the present enlightened government: a correct sketch of the various reservoirs and canals which this great river has formed for the reception and disemboguement of its immense volume of waters, will become the basis of the vast improvements which at a future day will be made upon this inestimable portion of the United States.

WILLIAM DUNBAR.

NATCHEZ, January 1, 1804.